MAUREPAS VGO PIPELINE

PROJECT DETAILS

Client:	American EPC Provider & Midstream Pipeline Operator
Location:	River Parishes LA, USA
Completion Date:	September 2017
Contract Scope:	Design, Engineering, Procurement, Construction, QA & Commissioning
Application:	One 12" Vacuum Gas Oil (VGO) Pipeline, 58 km (36 mi) in length from Convent Refinery to Norco Refinery, Minimum Soil Temp = 7°C (44°F), Maintain Temp = 54°C (129°F), Polyurethane Foam Thermal Insulation, Supply Voltage = 4.16 kV, 3-phase, 60 Hz, 5 circuits, Total Operating Load = 2.6 MVA
Technology:	nVent RAYCHEM Skin-effect Trace-Heating System (STS), Fiber Optic Distributed Temperature Sensing (DTS), Finite Element Analysis (FEA), Pre-insulated Pipe (PIP) and Self-regulating Heat-Tracing Cables on above-grade piping for the Pump Stations and Valves

KEY CHALLENGES

Design and installation of the Heat Management System for this heavy distillates VGO pipeline presented the following challenges:

- Construction of a 58 km (36 mi), buried and submerged Vacuum Gas Oil (VGO) pipeline crossing protected wetlands throughout the Gulf Coast region. With limited working areas in a swamp setting, conventional pipe laying methods would not work. The swamp environment and seasonal heavy rains also posed a challenge to construction.
- In addition to swamp land and dry trench construction, eight Horizontal Directional Drills (HDD's) were necessary. Several sections, some exceeding 610 m (2,000 ft) in length, were directionally drilled beneath rivers and major thoroughfares. These HDD occurrences (some more than 18 m (60 ft) below grade) presented a potential compromise to the insulation and heating systems.
- The pipeline routing provided limited opportunity to utilize the existing electrical grid power from the local utility company.

SOLUTION

World's first heated underground petroleum pipeline commissioned with Fiber Optic Distributed Temperature Sensing (DTS).

- An inherently safe RAYCHEM Skin-effect Trace-Heating System (STS), able to withstand high exposure temperatures and efficiently transfer heat to the pipe. Long circuits were designed, to create an optimized layout and minimize overall project costs by reducing the quantity of power substations and supporting infrastructure.
- Fiber Optic Based Distributed Temperature Sensing (DTS) system provided a dynamic pipeline temperature profile at each meter with 1°C accuracy for continuous monitoring of the temperature along the entire length of the pipeline. Although the DTS system was installed with the purpose of assisting operations during both normal and re-melt operating conditions, it also allowed for the constant monitoring of the inaccessible insulation system, including the HDD sections.
- State-of-the-art RAYCHEM temperature control and monitoring system with vacuum contractors, electrical fault protection and metering.
- Thermal Finite Element Analysis (FEA) 3D modeling to determine the anticipated temperature profile of VGO through the cross-section of the pipe.

Optimized thermal insulation coated with 2.5" concrete to overcome buoyancy

Pipeline is submerged 2 m (6 ft) below the swamp, crossing environmentally sensitive wetlands

- Seamless alignment with the pipeline contractor to develop an execution strategy in a remote and difficult setting. Large "work pads" were constructed from timber construction mats at key locations so the pipeline and heating systems could be constructed "on land" and launched into the marshland.
- Incorporation of a rigorous VLF (very low frequency) electrical testing program throughout pipeline construction to verify that installed systems remained intact.

SYSTEM DESIGN CONSIDERATIONS

- 12" VGO Pipeline is buried approximately 2 m (6ft) beneath the swamp surface, except at the pump station tie-ins to the refineries. VGO is heated to 71°C (160°F) at the refinery and maintained to a temperature of 54°C (129°F) (VGO begins to solidify at approximately 40°C (104°F)). 200 km (124 mi) of STS wire was supplied for the five STS circuits between 10 and 14 km (6 and 9 mi) in length.
- Strapped attachment of multiple 1" heat tubes and fiber optic encasement tube onto pre-insulated 12" pipe spools with 2.5" of load-bearing polyurethane foam and a High-density Polyethylene (HDPE) outer covering.
- Sections buried in the swamp were coated with 2.5" thick concrete to overcome buoyancy.
- A spare heat tube with STS conductor was pre-installed in case one of the two operating heaters were to fail.
- As pipeline strings were welded end-to-end, along with installation of the STS and fiber optic cables, the pipeline was launched into the water and supported by temporary flotation devices. It was then steered to its final location and eventually lowered beneath the water (by removing flotation) for backfilling operations.
- To accommodate for the eight Horizontal Directional Drills (HDD), the STS wire and fiber optic cable were pulled after these pipeline sections were pushed through the HDD's.
- Five MLV's (Motorized Line Valves), which control the product flow at key overland locations, are electrically traced. Each remote location is controlled with its own local controller/panel and operates at just under 1,500 W. An NGC-40 multi-point control panel is installed at each of the two large pump stations to provide heating for the pig traps, metering skids, drain lines, instrumentation and pumps.

nVent introduction of "intelligent pipelines" with state-of-the-art integrated technologies has resulted in a dramatic and significant development in the electrically heated pipeline transportation of VGO, resulting in a uniform pipe temperature for this long pipeline application.

nVent was fully responsible for design and engineering and service procurement of STS and FO DTS materials, project management, construction QA and commissioning of the entire project. By assuming a Quality Assurance and Commissioning responsibility for the heat management system, nVent TRACER Turnkey Solutions team ensured that these projects were completed on time, safely and to the satisfaction of both customers.

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